EDITORIAL

Technological Advancements in Dentistry: A Step Towards Successful Treatment

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Dear Editor,

Advancements in technology have impacted all areas of medicine, including dentistry. The blend of conventional medical knowledge and skills with state-of-the-art equipment and interdisciplinary collaboration has greatly enhanced the success rate of treatment outcomes and has saved valuable time.[1]

Finite element analysis (FEA), though used in all areas of dentistry, primarily it is used to design highly durable dental implants by stress analysis wherein researchers can predict potential failure points and improve implant design.[2] An important FEA study published in the Journal of Prosthetic Dentistry 2023 compared the stress distribution configuration in two varied zygomatic implants in severely atrophic maxilla and observed that stresses produced in the quad zygomatic models were relatively lesser as compared to the conventional treatment.[3] The authors further emphasized the incorporation of muscular forces into FEA studies to obtain accurate results. Finite element analysis can also aid in planning effective orthodontic treatment by simulating the effect of various stress and strain conditions on temporomandibular joints and related structures to address temporomandibular disorders (TMD).[4–6]

Computer-aided designing and computer-aided manufacturing (CAD/CAM) have revolutionized the treatment provided to patients. With advent of newer materials and technologies, dentists can deliver superior-quality prostheses to patients. According to a meta-analysis in 2022 that performed a qualitative analysis of 25 articles and a quantitative analysis of 12 articles on the properties of three-dimensional (3D)-printed interim crown and bridge resins compared with CAD/CAM milled and conventional interim resins, reported that though the physical properties of CAD/CAM milled, and conventional interim resins were superior to 3D-printed ones; however, the mechanical properties of 3D printed resins were superior.[7] Moreover, 3D imaging and CAD can assist the orthodontist in providing more predictable and favorable outcomes in managing TMD-related symptoms.[8]

The 3D models are transforming the medical field by providing a new outlook. They are used to: teach and perform mock surgeries; fabricate custom prostheses and surgical guides for implant placement and to visualize the anatomy which aids in surgical planning. The relevance of 3D printed models was affirmed by a survey by Povey et al. which reported that 3D-printed models helped 83% of patients better understand their condition and the outcome of planned surgery.[9] Additionally, surgeons responded that 3D models were used as an adjunct in complex surgeries for planning which helped them prepare and achieve better outcomes. Mathew et al.,[10] utilized DICOM data from MRI and CT scans to print 3D preoperative models which were used as a templates to customize a stock implant according to the patient's defect preoperatively. This reduced both the cost and time of the surgical procedures with very good postoperative results. A study conducted by radiologists from the USA,[11] mentioned that 3D models decreased the surgical time by 1 hour in simpler cases and up to 2.5 hours in complex cases, which corroborates the claim made by Mathew et al. with the availability of in-house cost-effective 3D printing, their utility is predicted to improve further.[12]

Introduction of robots in the dental field, especially in implantology, has shown promising results. A meta-analysis compared the accuracy of dental implants placed by robots with other conventional techniques including static and dynamic

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computer assisted implant placement.[13] The PRISMA guidelines were followed by the authors to conduct and document this article. Quantitative analysis was performed to evaluate the accuracy of robot-assisted implant placement compared with other techniques. The study concluded that the accuracy of implants placed in resin models was higher for surgeries performed with robotic assistance when compared to other computer-assisted implant surgeries.

Introduction of artificial intelligence (AI) has opened new avenues. Presently, AI is used in diagnosis and treatment planning in dentistry. The study by Thomas Ekert et al.[14] demonstrated the adequate capability of AI to distinguish apical lesions on panoramic X-rays.

These technological advancements enable dentists to provide high-quality treatment with predictable outcomes. Therefore, there is a prerequisite to inculcate these techniques and inventions into clinical practice.

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